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(54) Apparatus and method for removal and disposal of materials

(57) An apparatus (10) has a shovel (120) disposed on a relatively large wheel (100). A handle (133) is formed at the end of an elongate yoke (110). A load can be picked up, transported to a location, and propelled overboard with a quick arm/body motion on the part of a person operating the handle (133). The substantially waist-high wheel (100) is adapted to receive the body force of an operator as an effective leverage through the handle (133) and cause a recoil action from the wheel (100) to enhance the throwing power of the apparatus.

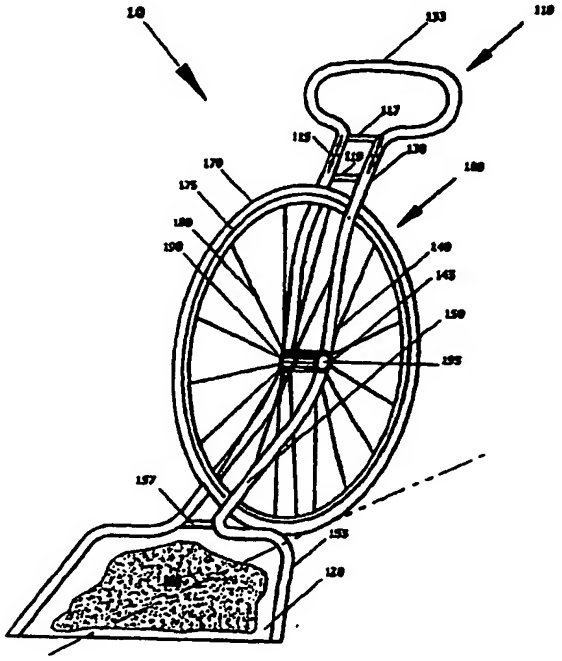

FIGURE 1

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Description

[0001] The present invention relates to apparatus and methods for removal and disposal of materials.

[0002] The invention relates generally to manual wheeled vehicles for moving and disposing materials. In an embodiment, the present invention relates to a snow removal shovel on a wheel which provides a recoil action to assist in propelling the snow.

[0003] Numerous manual wheeled vehicles have been in use to assist in transporting materials from one place to another. The age old wheelbarrow is, of course, well known. However, aside from transporting alone, loading onto and unloading of materials from a vehicle easily and with minimum stress and strain to the human body have required different approaches. This has been true for shoveling or plowing snow, including wet and heavy slushy snow.

[0004] In US Patent 5,918,921, Samuelson shows a levered shovel for moving snow. The shovel includes a blade for carrying the snow, a shaft that extends from the blade, a wheel assembly for contacting a horizontal surface and which depends from the shaft, and a handle assembly for gripping by the user and which is disposed on the rearmost end of the shaft. The wheel assembly comprises either an axle fork, an axle rotatively mounted to the axle fork, and a pair of wheels attached to the axle or an inverted T-shaped member with its transverse portion serving as its axle to which a pair of wheel are rotatively attached. The handle assembly comprises a lower transverse member for gripping by the hands of the user and extends laterally from both sides of the rearmost end of the shaft and an extender for elevating the point at which the user grips the handle assembly for users with limited bending posture.

[0005] Jurkowski, et al., disclose a wheeled snow shoveling device in US Patent 5,511,327. The shoveling device comprises a cart having a handle formed in a generally A-shaped configuration with a cross bar including a circular ring extending therefrom. The cart includes a wheel with an axle positioned at its axis, the wheel including a pair of vertical support bars affixed to the axle, the wheel also including a pair of horizontal braces affixed to its axle. The lower segment of the handle is coupled to the braces. A snow shovel has a blade formed as a generally rectangular shaped member and is molded into a semi circular configuration, the rear surface of the blade being coupled to the free ends of the horizontal braces of the cart wheel. The blade has a wooden shaft affixed to its rear surface, the shaft extending through the circular ring on the cross bar of the handle, the free ends of the vertical support bars being coupled to the shaft.

[0006] In another approach for removal of snow, Petruzzelli discloses in US Patent 6,675,507 an articulated shovel blade for pivoting movement relative to a wheeled carriage on which the blade is mounted. The shovel blade is adjustably locked in position at different angles relative to the direction of travel of the carriage, for pushing snow or other material to the side of the shovel as it travels across the ground. The carriage is pushed forward using a handle or a motor is provided for self-propelling the carriage.

[0007] In still another approach, Lobato describes in US Patent 5,581,915 a snowplow carriage assembly for removal of snow manually by plowing the snow in an area to be cleared of snow. The carriage is a manually propelled wheeled structure made of a plurality of members pivotally connected for collapsing and folding for storage and unfolding for use in supporting and transporting a snowplow in the form of a replaceable conventional snow shovel having a handle straight length portion. The carriage is configured so that the snow shovel handle is removably mounted thereon inclined from the horizontal defining an acute angle relative to a surface on which snow is being plowed. The snow shovel inclination is variable for establishing different acute angles of the shovel relative to the surface for plowing the snow thereon and removal therefrom.

[0008] In US Patent 6,643,958, Krejci discloses a snow throwing shovel device for removing snow from narrow sidewalks and from steps where a conventional snow blower cannot be used. The snow throwing shovel device includes a scoop assembly including a housing having top, bottom, side, and back walls, and also having an open front. The shovel also includes an elongate chute attached to the scoop through which snow is moved. The shovel further includes a discharge spout rotatably mounted to the elongate chute, handle members attached to the elongate chute; and an assembly for picking up snow and moving snow through the elongate chute.

[0009] The present state of prior of art, thus, generally provides two types of shovels which are particularly common. One type involves lifting and throwing of the snow, and the other involves pushing of the snow like plowing. These cited prior art references are incorporated by reference in their entirety. What is needed is a combination of the two types of snow shovels where the plowing type of action can be incorporated into a shovel which also lifts and throws the snow with ease and with least ergonomical discomfort.

[0010] In an embodiment, the present invention provides a wheeled shovel having a handle formed at the end of an elongate yoke, the yoke being mounted, near its middle portion, onto the axle of a relatively large wheel for the purposes of picking up of a load, transporting it to a destination, and propelling the load overboard with a quick body (or arm) motion on the part of a person operating the handle. The substantially waist-high wheel is adapted to receive the body force of an operator as an effective leverage through the handle and cause a recoil action from the wheel to enhance the throwing power of the apparatus of the invention, comprising the shovel, the wheel and the yoke as the driving member.

[0011] An embodiment of the present invention in-

volves an apparatus for removing and disposing materials. The apparatus comprises a wheel assembly having a rim and an axle connected together with spokes radially projecting from the axle. The axle includes a fulcrum member capable of transmitting a recoil reaction to an action. A driving member has an upper portion, a middle portion and a lower portion. The middle portion is generally "S-shape" and is attached to the fulcrum member of the axle. A handle is attached to the upper portion of the driving member and is capable of moving the wheel assembly. A blade is attached to the lower portion of the driving member, the blade being adapted to pick up a load of material from a surface when the blade is lowered to the surface by raising the handle and pushing forward. When the handle is pushed downwards, the downward action causes the wheel to compress and recoil through the fulcrum member at the axle of the wheel. As a result, the blade springs upwards and forwards, thereby propelling the load of material briskly away from the apparatus

[0012] An aspect of the embodiment of the present invention comprises a wheel assembly having a rim and an axle, the axle further comprising a tubular body having two ends adapted to receive spokes which connect the axle to the rim. The axle further is adapted to receive a plurality of springs at the two respective ends of the axle to act as a fulcrum, and transmit a recoil reaction to an action applied at the axle. An elongate U-shape driving member has a curved upper portion, a generally straight middle portion and an open lower portion. The middle portion is attached to the springs at each end of the axle. A handle forms the upper portion of the driving member, and is capable of moving the wheel assembly. A shovel blade attaches to the lower portion of the driving member, the shovel blade adapted to pick up material from a surface when the blade is lowered to the surface by raising the handle and pushing forward. The blade springs upwards and forwards, thereby releasing the material briskly away from the apparatus when the handle is pushed downwards to cause the springs to compress and recoil through the fulcrum member at the axle of the wheel.

[0013] The shovel blade, when configured in a complete arc having tapered walls on the front leading edge of the shovel blade, has been found to provide better handling characteristics due to an even distribution of the load on the shovel blade when a load, such as snow, is trapped on the blade and the load is sprung from the blade. A rounded back wall allows more even distribution of the load in the shovel blade. For example, when the load enters on one side of the shovel blade, it deflects off the curved back and directs the load to the less full or empty side. More uniform distribution of weight makes throwing easier and requires less user force to prevent tipping of the device to one side. When a flat section is in the back wall of the shovel blade, it has been found to cause the shovel blade to be prone to not distribute the load as uniformly and to cause undesired imbalances due to uneven distribution of a load, such as snow, on the shovel blade.

[0014] In one embodiment, without limitation, the walls of the shovel blade may at its highest point reach about 2 to about 4 inches and taper down to next to nothing near the edge of the shovel blade leading edge and the leading edge of the shovel may have a width of up to about 28 inches, for example between about 20 to about 28 inches, and the shovel blade may have a length from front to back of about 14 to about 22 inches or about 16 to about 20 inches.

[0015] Handling may further be improved when the shovel blade itself is curved as seen from its side perspective. The shovel blade has also been found to work better in retrieving and dispensing material when it is angled with respect to the plane under the shovel blade between any angle of from about 15° to about 35°, or from about 20° to about 30°.

[0016] The shovel blade may comprise one or more projections, e.g., a fork or pitchfork configuration, on the front end of the shovel blade to allow for easier pickup of load material, such as mulch or soil. When the load is anticipated to be snow, the shovel blade may further comprise an ice chipper attachment that extends in front of the leading edge of the shovel blade. In such case, the chipper edge, not the shovel blade edge, may touch the ground, but still allow loosened iced or packed snow to enter onto the shovel. The shovel blade may also be equipped with a metal wear strip on the leading edge of the shovel blade, which strip may or may not be replaceable.

[0017] The shovel blade may be attached to the yoke by a number of different mechanisms. For example, the shovel blade may be attached by fitting tubes into slots within or on the shovel. It has been found that attachment through an attachment plate on the underside of the shovel blade (non-load carrying side of the shovel blade) adds to the stiffness of the shovel blade while allowing the edge of the shovel blade to flex when hitting hard objects such as packed snow or ice. The plate may have a bend in it to extend further forward (closer to the leading edge) under the shovel blade to support it better. Plates are preferred over tubes as giving greater clearance (of course, the tube could also be flattened near the ends).

In an advantageous embodiment, the attachment plate attaches to the underside of the shovel blade at a point from about the middle of the shovel blade to about the leading edge of the shovel blade. For example, with a steel blade it has been found that the front end of an attachment plate located from about 2 to about 4 inches from the leading edge of the blade may provide an unexpectedly advantageous lift/stress area without the need for increasing overall blade material thickness and stiffness. Such attachment plate, and its positioning, may also provide the ability to incorporate more curve in the shovel blade when viewing the blade from the sides, thereby incorporating strength. The edges pref-

erably are more flexible.

[0018] The handle may be configured in a number of ways such as in a closed loop, open bar, dual handles, or straight bar. Hand grips on the handle may be used to improve grip on the device. A particularly useful bar is a curved bar with the curvature away from the machine (i.e., handles expanding out toward user).

[0019] In one embodiment, the handle is adjustable on the yoke such that the handle can be moved up or down. For example, the handle may be variably attached by use of movable bracket(s) or by sliding the handle portion into a portion of the yoke. In one embodiment, the handle is configured to comprise a moveable tube positioned within a gap of the yoke (e.g., collar) (for example, into a tube comprising a portion of the yoke) and can be slid in and out of the gap and rotated 360', preferably affixed in its final position.

[0020] In another embodiment, the handle component is attached to the yoke via attachments through one or more holes in the handle component(s) and one or more holes in the yoke portion interfacing with the handle. Preferably one or both of the handle component or yoke has multiple holes such that the handle can be repositioned up or down along the yoke by matching one of the holes in the handle component to the yoke portion such handle component will interface. The handle assembly may comprise, for example, one piece that is curved or rectangular/square/U-shape and is open at one end and that fits over a portion of each lateral side of the yoke.

[0021] In one embodiment, the length of the yoke including the handle is about 6 to about 7.5 feet, or about 6.5 to about 7 feet, and the height of the handle from a plane under the wheel is about 40 inches to about 52 inches. The width of the handles in such embodiment are about 21 to about a 26 inches, or about 23 to about 24 inches.

[0022] Another embodiment of the present invention involves a method of method of snow removal using an apparatus comprising a relatively large wheel substantially at the waist level of an operator. A U-shape yoke has a handle at a closed end, a shovel blade at an open end, and the yoke is mounted onto an axle of the wheel. The method involves an operator moving the apparatus along a path by pushing the handle and rolling the wheel in a direction commanded by the handle. The operator shoves onto the blade a load of material along the path of the apparatus. After picking up the load of material, the operator presses the handle downwards, to lift the shovel blade to a level that clears the path; adjusts further the level of the shovel blade to achieve a balanced load with respect to and over the axle of the wheel; transports the balanced load of material to a destination; and at destination, briskly applies body weight at the handle to propel the load of material to a substantial distance away from the apparatus.

[0023] Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an example of apparatus according to an embodiment of the present invention showing a relatively large wheel connected to a driving member in the shape of a yoke, the yoke having a handle at one end and a shovel blade at the other, for picking up, transporting and disposing of materials in general, and snow in particular;

Figure 2 is a top view of the apparatus of Figure 1, showing the placement of the shovel and wheel within the yoke, according to the present invention;

Figure 3 is a side view of the apparatus of Figure 2, showing an aspect of the adjustability of the handle of the apparatus;

Figure 4 is a schematic drawing of the apparatus of Figure 3 showing the various dimensional relationships of the components of the apparatus;

Figure 5 is another schematic drawing of the apparatus of Figure 3 showing the various forces acting at the fulcrum of the apparatus;

Figure 6 is a schematic drawing of an embodiment of the present invention showing the yoke having an "S-shape" middle portion and a handle which is rotatable and slidably extendable;

Figure 7 is a schematic drawing of an aspect of the present invention involving springs as an assist in propelling materials from the shovel blade;

Figure 8 is a schematic drawing of an aspect of an embodiment of the present invention showing blade rollers employed for ease of travel of the blade over rough ground, such as gravel surface;

Figure 9 shows a top view of an adjustable handle assembly;

Figure 10 shows a handle assembly including an adjustable handle element capable of 360° fixed rotation;

Figure 11 shows a side view of an exemplary yoke having an adjustable notched element in its middle portion;

Figure 12 shows a top view of a shovel blade having arced walls;

Figure 13 shows the side cut view of an angled shovel blade;

Figure 14 shows a top view of a shovel blade-yoke

attachment assembly having an attachment plate adjoining two elements of the yoke;

Figure 15 shows a top view of a shovel blade-yoke attachment assembly having an angled attachment plate adjoining two elements of the yoke;

Figure 16 shows a cut side view of the shovel blade-yoke attachment with angled attachment plate of Figure 15;

Figure 17 shows a perspective view of an adjustable handle assembly embodiment; and,

Figure 18 shows a perspective view of yet another adjustable handle assembly embodiment.

[0024] Referring now to the drawings, Figures 1-8 show embodiments of the present invention involving the pick up, transport and disposal of materials in an efficient and effective manner.

[0025] Reference numeral 10 in Figure 1 generally refers to an apparatus representing an embodiment of the present invention comprising a wheel assembly 100, and a driving member 110 resembling substantially a U-shape yoke having a handle 133 at its closed and a shovel blade 120 attached to its open end, wherein the yoke is mounted onto axle 190 of the wheel. The wheel and the blade are incorporated into the driving member in a manner that the blade rests on the ground in its normal position. An operator uses the handle to move the shovel in any direction by rolling the wheel on the ground. The operator also uses the handle to guide the shovel in shovelling into the blade material lying along its path. The operator then lifts the shovel blade off the ground to pick up a load of material, followed by further lifting to balance the load at a comfortable walking posture. At destination, the operator presses on the handle with a quick downward body (or arm) motion, to propel the load away from the shovel. The operator can dispose the material either straight ahead by directing the shovel in the direction of the motion of the apparatus, or to the side by flipping the shovel sideways.

[0026] It will be appreciated by those skilled in the art and by ordinary users of snow shovels that the large wheel 100 shown in Figure 1 (as further defined below and depicted in Figure 3 relative to human dimensions) enables a user to lift the blade and snow above unshovelled snow height and travel over it and any rough surface without compressing unshovelled area to be traversed. The relatively high-level handle of the shovel enables the user to comfortably accelerate the load of snow forward off the blade while pushing down the handle, which enhances the throw distance of the snow trajectory.

[0027] The wheel assembly 100, driving member 110 and shovel 120 are formed ergonomically to assist in picking up and releasing a heap of material 160, such as sand, gravel or snow, generally aligned in the direction of motion, with least stress to the body of the operator, and especially to prevent back stress or injury. As will be explained in more detail later, a recoil assist is provided to the action of the operator of the apparatus from a fulcrum area of the apparatus to release the material in a brisk and efficient manner. The material can also be picked up and released while the wheel is stationary. Furthermore, the material can be throwingly released, or propelled, forward or sideways, as desired, while the wheel is stationary or in motion.

[0028] In an embodiment of the present invention shown in Figure 1, driving member 110 is formed preferably of continuous metal tubing that is shaped to have a handle 133 in its upper portion 130, a fulcrum bearing area 145 in middle portion 140 and an open frame 155 in the lower portion 150 to accept blade 120. Handle 133 is extendable at 115 to permit length, height and leverage adjustments, as will be described in more detail later. Fulcrum bearing area 145 shown in the same Figure 1 comprises an opening in the middle portion 140 of the driving member, preferably capable of receiving a roller bearing (not shown). A portion 195 of axle 190 of the wheel assembly 100 fits inside the fulcrum area 145 of the driving member. The attachment point at 145 is designed to reconfigure the shovel for user height, strength and snow conditions. An attachment that can slide along the middle portion of the driving member can be used to adjust the height of the handle for leverage as well as for ease of operation of the apparatus. Aspects of the function of the fulcrum, and attachments thereto, will be explained in more detail below with respect to the relationship of the fulcrum to the handle and the shovel for disposing of materials from the shovel in a brisk, and yet ergonomically advantageous manner.

[0029] In an aspect of the embodiment shown in Figure 1, the driving member 110 is formed in an elongate U-shape, resembling a yoke, with an upper portion providing the handle 133, and a narrowed middle portion 140 with distal sides to accommodate the axle 125 of the wheel assembly 100. The distance between the relatively long legs (encompassing generally the middle portion 140) of the U-shape driving member 110 is determined by braces 117, 119 and 157 formed judiciously between the legs so that the axle fits in the fulcrum areas 145. It will be known to those skilled in the art that any number of different ways can be employed to attach the axle of the wheel in the openings forming the fulcrum areas 145. For example, the well-known quick release for bicycle wheels can be employed. Alternatively, the axle in the form of a tube having protrusions 195 with inside shoulders (not shown) can be snapped into openings 145 by gently spreading apart the legs 140 of the U-shape driving member. These wheel mounting features are well known in the art and are therefore not described in detail here. It is preferred that the tubing material for the driving member 110 comprises hollow aluminum, or other metal tubing. Non-metallic materials,

such as plastics, may also be used.

[0030] In another aspect of an embodiment of the present invention, wheel assembly 100 comprises a wheel 170, a rim 175 and spokes 180 which connect the axle 190 to rim 175, as shown in Figure 1 and in top view of Figure 2. Different types of wheels, including different treads, widths or a continuous web connecting the axle to the rim can also be used. Relatively narrow wheels, such as shown in Figure 1, provide the advantage of not packing down snow, for example, when shoveling snow. The dimensions of wheel 170 and the position of handle 133 relative to axle 190 of the wheel are determined generally with respect to the position of the arms of a human body. A relative position of handle 133 with respect to a general body posture is shown in Figure 3.

[0031] In still another aspect of an embodiment of the present invention shown in Figure 4, it is preferred that the wheel diameter a is between about 30 to 36 inches, while the height of handle 110 from a datum plane directly under the wheel, that is, from a ground datum x, is between about 48 to 60 inches. The height of handle 133 from the center of axle 195 is preferably between about 26 to 42 inches. In another aspect of the present invention, further adjustment of the height of the handle is provided by a telescoping means 115, such as a sliding hollow outer tube over an inner tube as shown in Figure 3, which ensures better ergonomic comfort. The overall length d of the wheeled shovel is between about 78 to 88 inches. Distance e from the tip of the shovel blade 120 to the fulcrum area 145 near the center of the wheel assembly 100 is between about 32 to 42 inches. Distance f from the fulcrum area to the tip of the handle shown in Figure 4 can be varied depending upon the preferences on the part of the operator. For example, distance f can be adjusted to make it easier to pick up and lift a load, balance the load on the apparatus more evenly for ease of transport to a location, and/or to gain more leverage in shoving the load from the shovel at the location of interest.

[0032] Thus, it will be apparent to those skilled in the art that the relationship between the relatively large diameter of the wheel, overall length of the shovel and the height of the shovel handle from the ground determine the ease with which snow may be shoveled. The chest-high position of the handle assists in pushing the accumulated snow or other material that is being shovelled. A ratio greater than 1:1 between the length of the yoke and the height of the handle provides the ease with which a blade full of snow can be lifted as the handle is lowered. This leverage ratio can be varied by varying the point at which the yoke connects to the axle. Furthermore, differently shaped yokes, such as shown in Figures 4 and 5, contribute differently to the efficiency of the shovel. A preferred "S-shape" yoke is shown in Figure 6, and will be described in more detail later.

[0033] In addition to the ergonomic advantages, the embodiments of the present invention provide enhanced functional performance through a judicious use of a fulcrum line formed at the central portion of the wheel assembly shown in Figure 5. Line x' passing through the center of the fulcrum area 145 parallel to the ground datum line x forms the fulcrum line. A force F applied to the fulcrum through an action at the handle 133 can be resolved into a horizontal component F_h and a downward vertical component Fv, as shown in Figure 5. With no substantial resistance to the horizontal component F_h, the wheel rolls to the left, in accordance with the direction of the applied force F shown in Figure 5, while the ground under the wheel reacts to the downward component Fv giving rise to an upward recoil reaction -Fv by the wheel. A brisk and mostly downward action on the handle, using arm and/or body weight, for example, produces a recoil assist to the throwing power. The magnitudes of the component vectors are determined by angle β, and of the transmittal force F substantially by angle θ. Angle Q contributes to the throwing power. Furthermore, the shovel blade can be formed in different configurations to assist in efficient release of material 160 from the shovel. For example, the shovel blade can have a bottom portion with a relatively large radius of curvature p, resembling a scoop, for easy slide of material from the shovel, as well as for keeping the material from sliding backwards and spilling off the shovel. It will be appreciated by those skilled in the art that that these various parameters can be set to values that are commensurate with the ergonomic and functional requirements of the apparatus of the present invention.

[0034] Figure 12 shows a shovel blade 245 having a load-carrying inner surface 260 having arced walls 250 having the side walls tapering to near nothing near the leading edge 255 of the shovel blade 245 (both side walls are tapered). In a preferred embodiment shown in Figure 13, the shovel blade 245 is arced in side view 265 so as to form an angle between its upper and lower portion.

[0035] Figure 6 illustrates a preferred embodiment of the invention with similar characters and numerals referring to similar parts throughout the several views. The side view of the yoke shown in Figure 6 has an upper portion 130, middle portion 140 and a lower portion 150. The yoke is attached to wheel 170 (shown in phantom) at its axle 195 (not shown) in a notch o of a slidable sleeve 143. Sleeve 143 can be slid (in the direction of either one of the arrows shown in the same figure) over portion 150 of the yoke to change the position of fulcrum 145, the effective leverage length f and the "throw arm" e. The throw is accomplished by pushing handle 133 in a downward direction to the phantom position 133'. The primed reference numerals, namely, 130', 135', 140', 150' and 120', show other parts of the yoke 110, including the shovel blade, in a position following the downward motion of the handle of the yoke 110. It will be understood by those skilled in the art that various different mechanisms can be used to adjust the fulcrum point to achieve the desired leverage for throwing the load off

the shovel.

[0036] In Figure 11, there is shown a side view of a yoke or driving member 110 having an adjustable length notched element 205, for example a bar, in the middle portion with one or more notches 210. This allows the fulcrum point to be changed without changing, or reducing the amount of change in, the height of the handle above a plane positioned at the bottom of the wheel necessary to effect the same applied-force:load-displaced ratio, the length of the yoke portion above the middle portion and/or changing the length of the yoke portion below the middle portion. The notches may be various shapes such as rectangular, square, circular, or angled. Angled slots may be preferred as they may reduce the inclination of the wheel in respect to the notched element to permit better fixation.

[0037] By changing the notch 210 associated with the axle (e.g., the axle sitting in the notch), the leverage changes even if the structure, height and/or length of the yoke 110 does not change. The notched element 205 may further be configured such that repositioning along the element among the notches can cause a change in the angle of the shovel blade with respect to the ground, such as a change from shape 215 to shape 220. Reducing the angle of the shovel blade as it strikes the ground reduces friction. In such embodiment, there is shown a yoke 110 having a handle section 133, an "S-curve" middle section having an upper elbow 225, a lower elbow 230, a middle elbow 235, a linear section 240, and a shovel blade section of shape 215 and shape 220. Figures 11b and 11c illustrate other notched element 205 embodiments that may be employed (only a portion of yoke 110 is shown). Notched element 205 of Figure 11b illustrates angled notches 210' which allow for improved holding of the yoke 110 to the axle as the yoke 110 is moved back and forth. Notched element 205 of Figure 11c comprises openings 210" in the form of holes. Attachment through holes further enhances the holding of the yoke 110 to the axle as the yoke 110 is moved back and forth.

[0038] An aspect of an embodiment of the present invention involves an "S-curve" section forming the middle portion 140 of the yoke shown in Figure 6. The substantially "S-curve" (including the substantially straight section in the middle portion of the curve) is integral to optimizing "gearing"/leveraging in order to enhance the acceleration of the blade and throwing of the load faster, higher and farther from the shovel. The "S" shape is formed to have the lower curve subtending angle Φ. Angle Φ of the lower portion of the "S-curve" and angle Φ' of the upper portion, as shown in Figure 6, are both preferred to be between about 80° and 90°, though it will be appreciated that other angles may also be used. In one embodiment (not shown), with unanticipated leverage ability, the included angle Φ' is between about 80° to about 120°, or more advantageously between about 80° to about 100°, and more preferably between about 80° to about 90°, and the angle Φ is between about 110° to about 165°, or more preferably about 120° to about 155°. In such cases, the upper angle with the lower angle provide for a top handle section that can be relatively straight and horizontal. This may enhance performance, for example, by allowing a straight section that allows for ease in handle-length extension without necessarily the need to significantly change handle height as compared to other configurations. It may also allow the user to exert greater force without unduly increasing the friction of the shovel with the ground as compared to other configurations. Turning back to Figure 6, as handle 133 is lowered, the elbow of the lower portion of the "S-curve" travels a distance A through arcs Σ_1 and Σ_2, as shown in the same Figure 6. The straight portion of the S-curve traverses the arcs Δ_1 and Δ_2. As the handle is lowered, the "S-curve" starts moving downward and the handle thus only needs to be lowered an amount equal to T in order to lift blade 120 to height M in new position 120'. As the middle portion 140 comprising the "S-curve", including the straight section, is positioned closer to the fulcrum area 145, the magnitude of A and leverage ratio M/T (the ratio of blade lift to handle movement) vary accordingly. It is preferred that the length H of the straight section of the "S-curve" is greater than A so that throughout the entire range of handle motion, the desired leverage (based on axle attachment point) or "gearing" is maintained as the blade is raised and lowered. Thus, for optimal operation (i.e., comfortably, and without bending on the part of the operator of the shovel) it is preferred that the maximum travel T of handle $T>H>A$, $\Delta_1 \approx \Delta_2$, and $\Sigma_1 \approx \Sigma_2$.

[0039] In another aspect of the present invention, the handle portion 133 shown in Figure 6 has a shank 134, which slidably and rotatably fits inside hollow sleeve section 135. Handle 133 can be pulled out, pushed in and/or rotated in order to find the most ergonomic position for shoving, picking up and throwing a load from the shovel. Shank 134 can be slid to any one of continuous positions along sleeve 135 by utilizing friction hold against the inside surface of the hollow sleeve 135. However, pins 137 are preferred which engage holes 139 judiciously placed along the length of section 135. Length E along handle 133 is between about 12 to 18 inches, while length L along section 135 is between about 16 to 24 inches, although other lengths can also be used. The overall length d of the shovel apparatus can be increased by Δ_d, preferably between about 6 to 12 inches, while the overall height c can be increased by Δ_c, preferably between about 4 to 8 inches, thus yielding an overall length G between about 89 to 100 inches and overall height I between about 42 to 66 inches. With the preferred dimensions cited here, the shovel blade can be comfortably raised to a height between about 36 to 44 inches.

[0040] Figure 9 shows a handle assembly 275 wherein a "U-shape" handle bar 280 is housed in its middle part in cross housing 290 supported by two support bars 300, 300'. "U-shape" handle bar 280 is shown to be mov-

able within cross housing 290 comprising a tubular housing. Handle bar 280 is also shown to comprise hand grips 305, 305'.

[0041] Figure 10 shows a handle assembly 275' wherein the assembly includes adjustable handle elements 310, 310' inserted into open tubular handles 315, 315' (315, 315' each show two configurations of the handle element). Such handle elements provide friction to the inner walls of open tubular handle 315, 315' and permit sliding of the adjustable handle elements within 315, 315' to allow for 360° movement. Handle elements 315, 315' may be covered with a covering (not shown) for aesthetic reasons and/or for easier gripping.

[0042] Figure 17(A) shows a perspective view of a handle assembly embodiment 350. Such embodiment includes an attachment plate 355 which may be, for example, welded or attached in some other fashion to the yoke 387. Attachment plate 355 includes a plurality of attachment conduits 360, shown as holes in the illustration, positioned for attaching engagement with corresponding attachment conduits 360', also shown as holes in the illustration, associated with handle 370. Handle 370 is shown to comprise a horizontal bar 375, which may be tubular in configuration, fixed to a bent plate portion 380 having a lower portion comprising attachment conduits 360'. Conduit(s) 360' can be attached to corresponding conduit 360 in attachment plate 355 by way of fastener 385, such as a bolt. The bend in the bent plate portion 380 of handle 370 allows the handle to be flipped over and installed upside down to change handle height, and the different attachment conduits allow the handle height to be set at different heights. Figure 17(B) shows another handle assembly embodiment wherein the end of the yoke is adapted to include an expanded open attachment end 387 having a top attachment plate 355' with attachment conduits 360 (shown as holes), a bottom plate (not shown) opposed to said top attachment plate 355' (the bottom plate also preferably constituting an attachment plate with attachment conduits), and an open end 386 configured to permit the bent portion of handle 370 to fit between the top attachment plate 355' and the bottom plate. One or more, preferably all, attachment conduits in top attachment plate 355', in the bent portion of handle 370, and in the bottom attachment plate (not shown) are preferably matched to allow a fastener 385, for example a bolt, to pass through each. Fastener 385 may lock the attachment through other attachments such as a nut 362.

[0043] Figure 18 shows a perspective view of yet another adjustable handle assembly 390. Such embodiment also comprises a handle 370 comprising a horizontal bar 375 affixed to a bent plate portion 380 having a lower portion comprising attachment conduits 360'. As opposed to the embodiment in Figure 17, rather than attachment plate 355 (of Figure 17), corresponding conduits 360 are found in the yoke proper 387. Conduit(s) 360' can be attached to corresponding conduit(s) 360 in yoke 387 by way of a fastener 385, for example a bolt. Alternatively, such attachment of handle 370 to yoke 387 can be done by slotted section such that they attach to one another without a fastener but are still secure (not shown).

[0044] In another embodiment, plural springs 200 (only one shown in the side view in Figure 7) are utilized to provide an enhanced recoil reaction at the fulcrum line. This may be particularly advantageous when the tire used for the wheel 170 is not as flexible as, for example, a bicycle tire with a pneumatic tube. In Figure 7, axle 190 is adapted to receive one spring at each of the two respective ends 195 of the axle which act as a fulcrum and transmit a recoil reaction to shovel blade from an action applied at the axle.

[0045] In still another embodiment, rollers 210 are attached to the bottom of shovel blade 120 for ease of traversing over rough ground surface 220, such as gravel, as shown in Figure 8. It will be obvious to those skilled in the art that rollers will also reduce friction with the ground, especially as more load accumulates on the shovel while the shovel is being pushed forward to pick up more material, such as snow, from the ground. Similar rollers with similar reference numerals are shown in Figure 6 where the primed numeral corresponds to the position of the rollers when shovel 120 is elevated. As seen in Figure 6, the shovel to which the roller is attached has a lateral dimension P between about 15 to 18 inches.

[0046] Figures 14 to 16 show a shovel blade-yoke attachment assembly 320. Such assembly includes yoke blade attachment ends 330, 330' and attachment plate 325 having a plurality of attachment portions 335, shown in the figure as a number of holes through which affixing devices, such as bolts, may be placed. The attachment to the shovel blade may or may not entail components or load surface of the shovel blade. In Figure 15, a preferred attachment plate 325 having a horizontal plane portion 340 and angled plane portion 345 are shown. The included angle may be about 120° to about 170°, or more preferably about 130° to about 150°. The angle gives strength to resist bending of the plate. The angled plane portion 345, when not affixed to the shovel blade, allows a flexing and recoil of the shovel blade, aiding in loading and unloading of a load. Figure 16 shows a cross-sectional view of such angled plate.

[0047] The embodiments of the present invention shown in the drawings are adaptable for various enhancements and improvements in useful ways. For example, a shovel blade may be designed with a more flexible material to enhance the ability to throw the shovel load. The flexibility of the blade provides a trampoline effect as the blades flexes back to its original shape from a bent shape as it accelerates to unload the load. A comparable effect is obtained by attaching the shovel blade to the shovel yoke with a spring-loaded hinge (not shown) that enhances the throwing capacity of the wheeled shovel. Furthermore, shovel blade 120 is pref-

erably fitted with side walls 125 as shown in Figure 3 in order to be able to pick up and retain liquid-like substances, such as snow slush. In another aspect, the driving member, resembling a yoke, is made to fold at the fulcrum area where a quick release wheel is mounted and removed readily for ease of transporting the apparatus. As an alternative, the driving member comprises two halves (not shown) attached to each other at the fulcrum area 145 of Figure 1. It will also be understood that a plurality of wheels of various widths can be used instead of the one wheel shown in the drawings. Further, the apparatus can be motorized to pick up, transport and propel a load of material from the wheeled shovel. Also, motor energy can be utilized to store energy in a spring or in other energy storing device, which in turn can be used on demand to assist in pushing and/or throwing the load on the shovel.

[0048] Embodiments of the present invention have been described with particular reference to the examples illustrated. However, it will be appreciated that variations and modifications may be made to the examples described within the scope of the present invention.

Claims

1. Apparatus for removal and disposal of materials, the apparatus comprising:

   a wheel assembly having a wheel and an axle, the axle including a fulcrum member capable of transmitting a recoil reaction to an action;
   a yoke having an upper portion, a middle portion and a lower portion, wherein the middle portion is attached to the fulcrum member of the axle and has an "S-shape" defined by a lower portion included angle Φ and an upper portion included angle Φ' where Φ' is between 80° and 120°;
   a handle on the upper portion of the driving member for allowing the wheel assembly to be moved, wherein the ratio of the length of the yoke to the height of the handle is greater than 1:1; and,
   a blade on the lower portion of the driving member, the blade being adapted to pick up a load of material from a surface when the blade is lowered to the surface by raising the handle and pushing forward, wherein in use the blade springs upwards and forwards, thereby releasing the load of material briskly away from the apparatus when the handle is pushed downwards to cause the wheel to compress and recoil through the fulcrum member at the axle of the wheel.

2. Apparatus according to claim 1, wherein the lower portion included angle Φ is between about 110° to about 165°.

3. Apparatus according to claim 1, wherein the lower portion included angle Φ is between about 140° to about 160°.

4. Apparatus according to claim 1, wherein the lower portion included angle Φ is between 80° and 90°.

5. Apparatus according to any of claims 1 to 4, wherein the upper portion included angle Φ is between about 80° to about 90°.

6. Apparatus according to any of claims 1 to 5, wherein the wheel assembly has a quick release for disconnecting the wheel assembly from the driving member.

7. Apparatus according to any of claims 1 to 6, wherein the blade comprises a curved surface and has side walls along its periphery tapered from the back of the blade to the leading edge of the blade.

8. Apparatus according to any of claims 1 to 7, wherein the yoke has a notched element in said middle portion, wherein the notches are configured to allow different positional attachment of the yoke in respect of the axle.

9. Apparatus according to any of claims 1 to 8, wherein the blade is attached to the yoke by way of an attachment plate having corresponding holes as found in the blade and a fixation element fixing the corresponding holes to one another.

10. Apparatus according to claim 9, wherein the attachment plate is angled.

11. Apparatus according to any of claims 1 to 10, wherein the handle is configured to be adjustable in position in respect of the yoke.

12. An apparatus for removal and disposal of materials, the apparatus comprising:

    a wheel assembly having a rim and an axle;
    the axle having a plurality of springs at the two respective ends of the axle to act as a fulcrum and transmit a recoil reaction to an action applied at the axle;
    an elongate U-shape driving member having a curved upper portion, a generally straight middle portion and an open lower portion, wherein the middle portion is attached to the springs at each end of the axle;
    a handle formed from the upper portion of the driving member for allowing the wheel assembly to be moved; and,

a shovel blade on the lower portion of the driving member, the shovel blade being adapted to pick up material from a surface when the blade is lowered to the surface by raising the handle and pushing forward, wherein in use the blade springs upwards and forwards, thereby releasing the material briskly away from the apparatus when the handle is pushed downwards to cause the springs to compress and recoil through the fulcrum member at the axle of the wheel.

13. Apparatus according to claim 12, wherein the axle comprises a tubular body having first and second ends which support spokes connecting the axle to the rim, the tubular body forming the fulcrum member.

14. Apparatus according to claim 12 or claim 13, wherein the plurality of springs comprise a pair of springs, one spring being provided at each end of the two ends of the axle.

15. Apparatus according to any of claims 12 to 14, wherein the springs are compressed when the handle is pushed downwards to provide the recoil action.

16. Apparatus according to any of claims 12 to 15, wherein the blade has two side walls and a back wall to keep the load of material from spilling out from the blade.

17. Apparatus according to any of claims 12 to 16, wherein the blade is in the form of a scoop having a radius at the bottom.

18. Apparatus according to any of claims 1 to 17, wherein the handle is slidably adjustable through a telescoping tubular material inside a hollow tubular driving member.

19. A method of snow removal using an apparatus comprising a relatively large wheel substantially at the waist level of an operator, a yoke having a closed handle end and an open end, a shovel blade at the open end of the yoke, wherein the yoke is mounted onto an axle of the wheel at a middle portion which is generally "S-shape" having an upper portion comprising an upper elbow and a lower portion comprising a lower elbow, wherein the yoke is mounted onto the axle and configured in a manner such that upon movement of the yoke about the axle, the upper elbow moves a distance H that is greater than the distance A moved by the lower elbow, the method comprising:

moving the apparatus along a path by pushing the handle and rolling the wheel in a direction commanded by the handle;
shoving onto the blade a load of material lying along the path of the apparatus;
pressing the handle downwards, after picking up the load of material, to lift the shovel blade to a level that clears the path;
adjusting further the level of the shovel blade to achieve a balanced load with respect to and over the axle of the wheel;
transporting the balanced load of material to a destination; and,
at the destination briskly applying body weight at the handle to propel the load of material to a substantial distance away from the apparatus.

20. A method according to claim 19, wherein the yoke of the apparatus has a middle portion between the upper and lower elbow having a notched element configured to allow different positional attachment of the yoke in respect of the axle.

21. A method according to claim 19 or claim 20, wherein the apparatus has a "T-shape" handle attached to a bent yoke attachment plate.

22. A method according to any of claims 19 to 21, wherein the apparatus has a handle portion adjustable in position with respect to the yoke.

23. A method according to any of claims 19 to 22, wherein the apparatus has a handle portion that can rotate 360°.

24. A method according to any of claims 19 to 23, wherein the axle has a plurality of springs at the two respective ends of the axle to act as a fulcrum and transmit a recoil reaction to an action applied at the axle.

25. A method according to any of claims 19 to 24, wherein the wheel is adapted to receive an elastic material capable of producing a recoil action to an action applied at the axle.

26. A method according to any of claims 19 to 25, wherein the shovel blade has arced side walls tapering toward the leading edge of the shovel blade.

27. A method according to any of claims 19 to 26, wherein the apparatus has a curved shovel blade.

28. A method according to any of claims 19 to 27, wherein the shovel blade is attached to the yoke through an angled attachment plate.

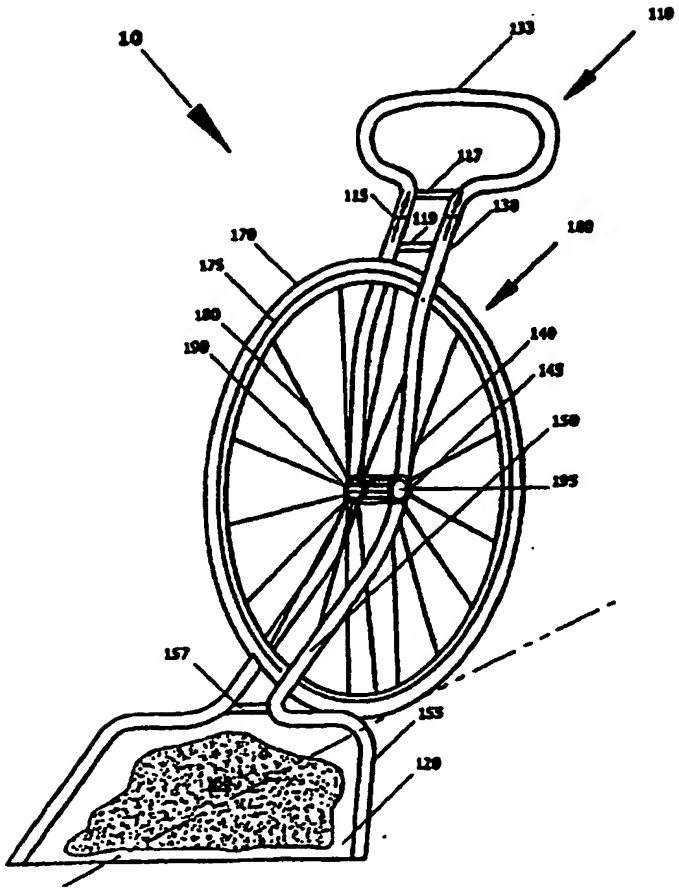
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FIGURE 1

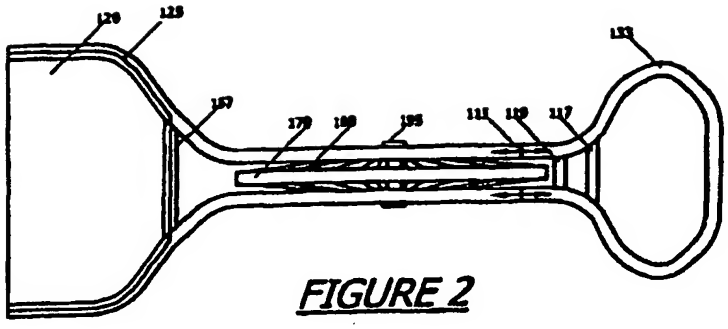
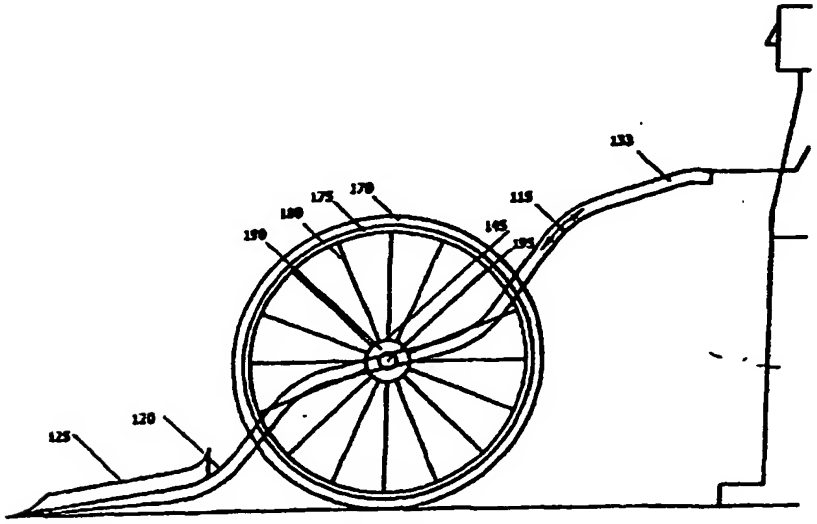


FIGURE 2



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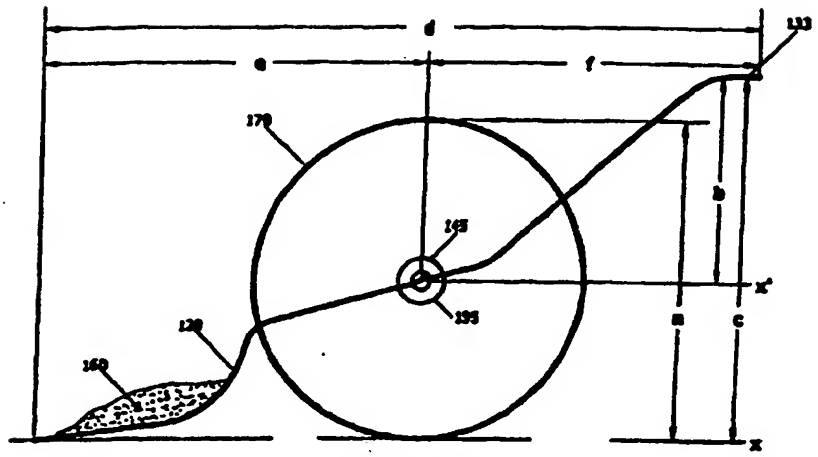

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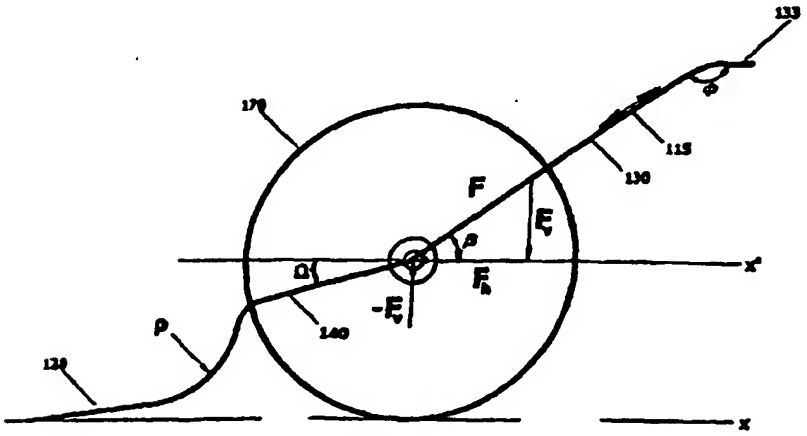

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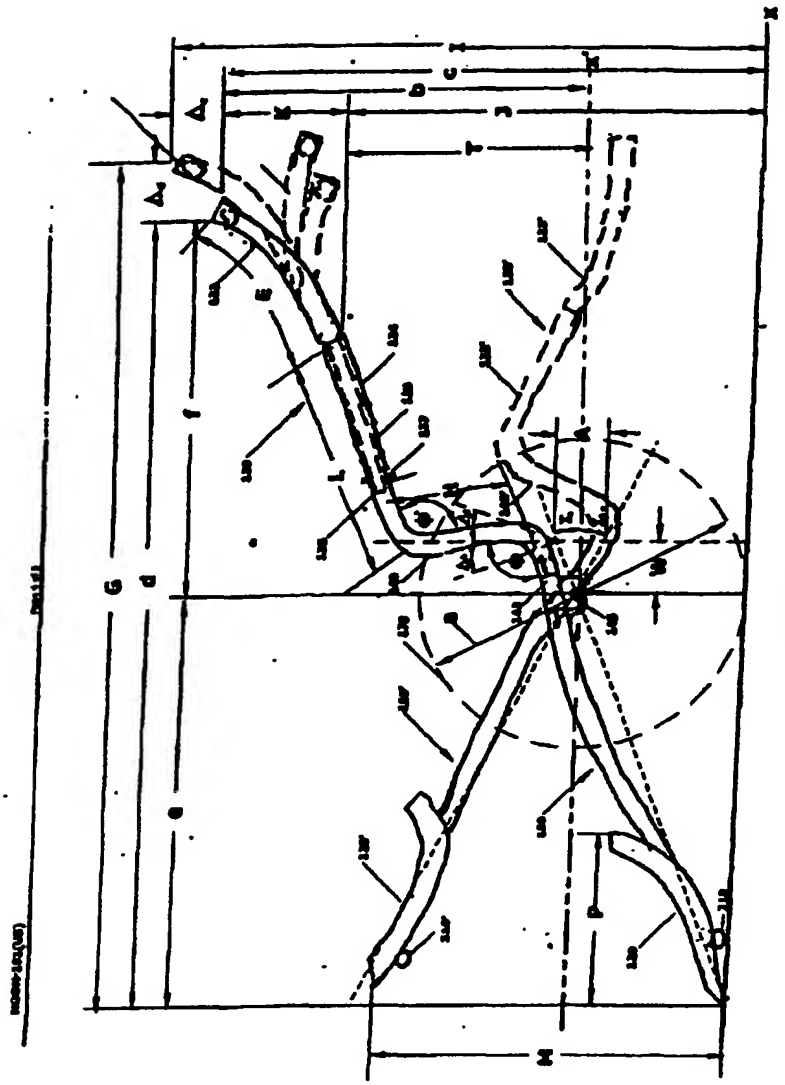

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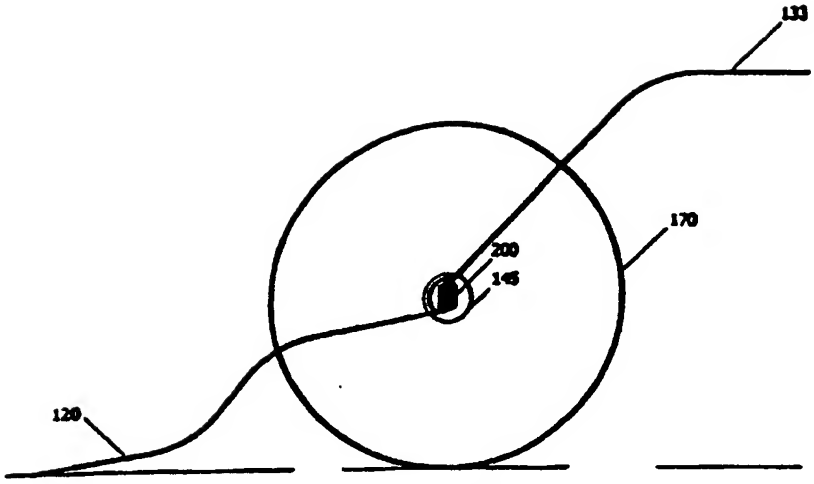

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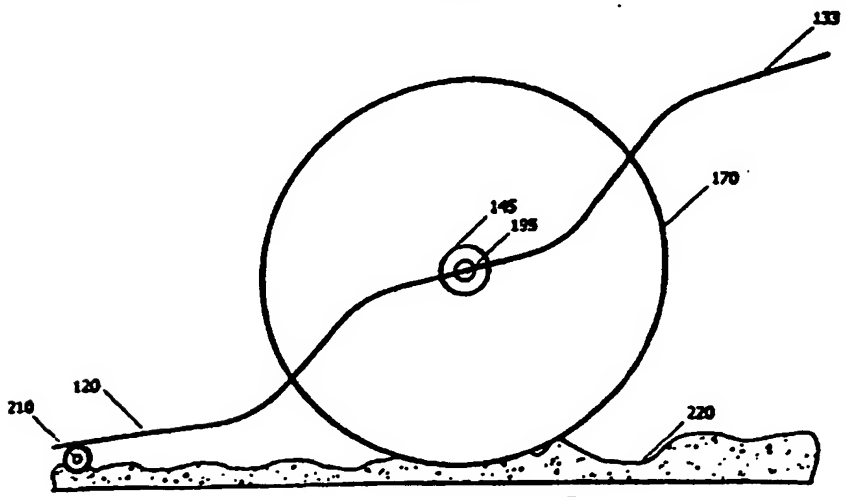


FIGURE 8

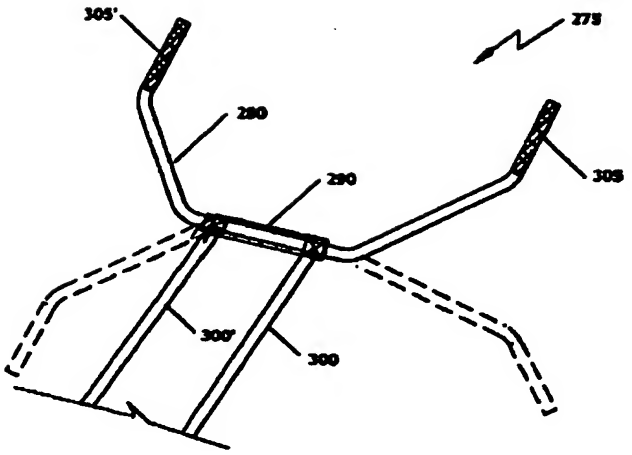


FIGURE 9

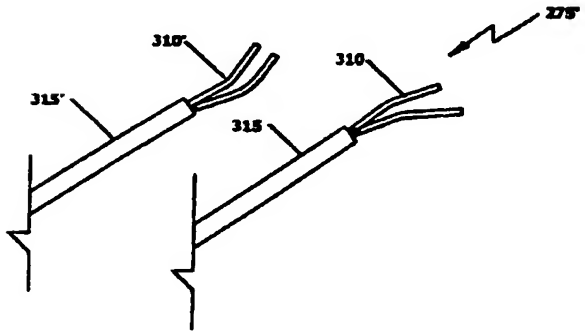


FIGURE 10

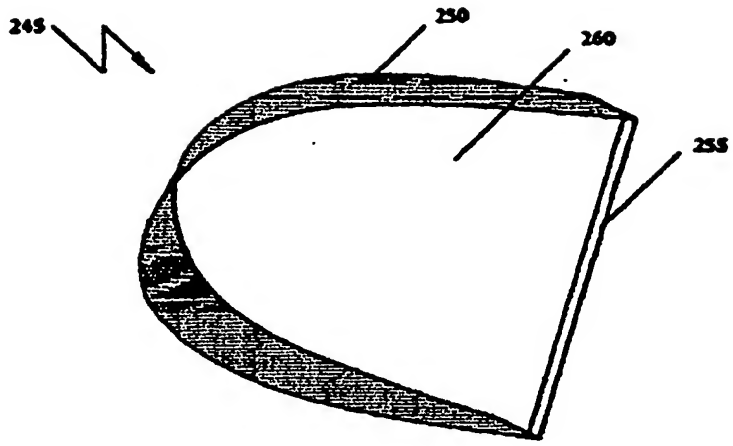


FIGURE 12

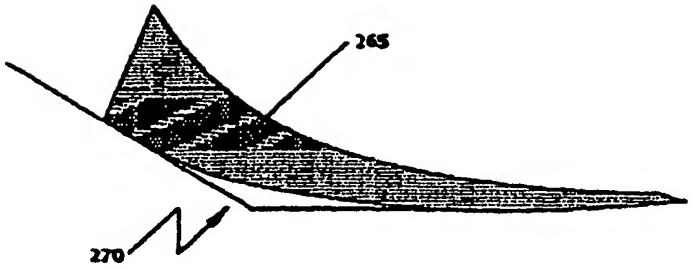


FIGURE 13

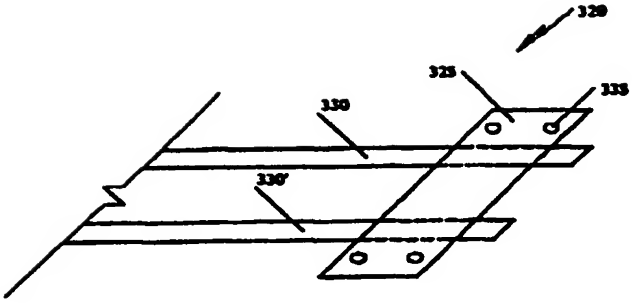
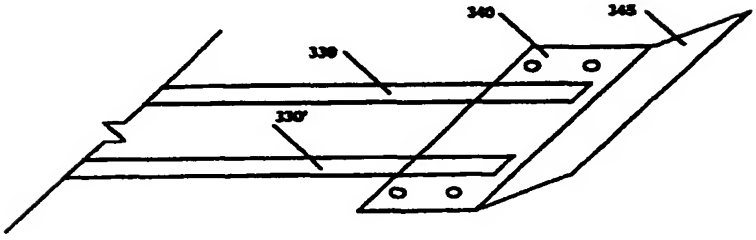


FIGURE 14



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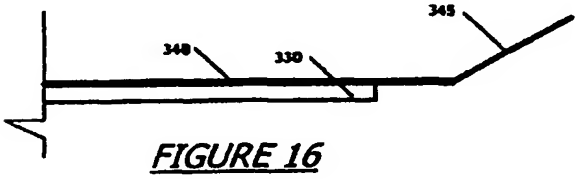

FIGURE 16

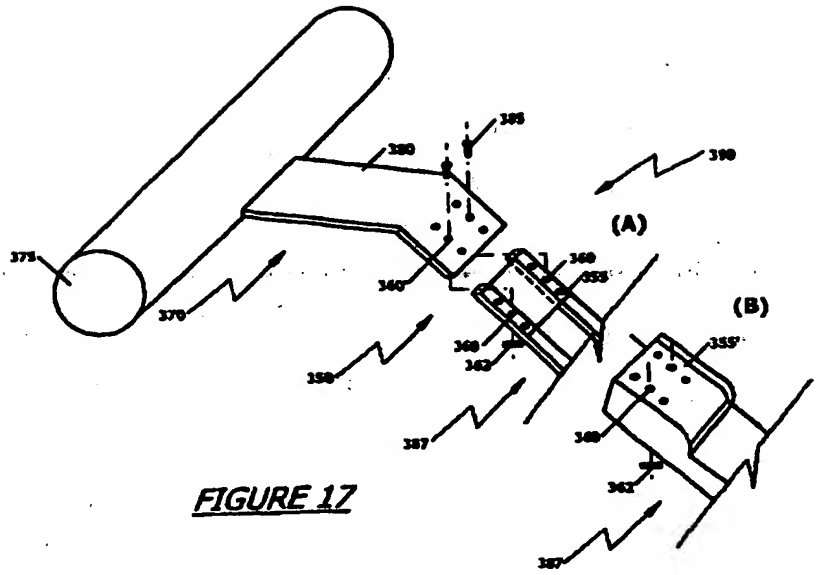

FIGURE 17

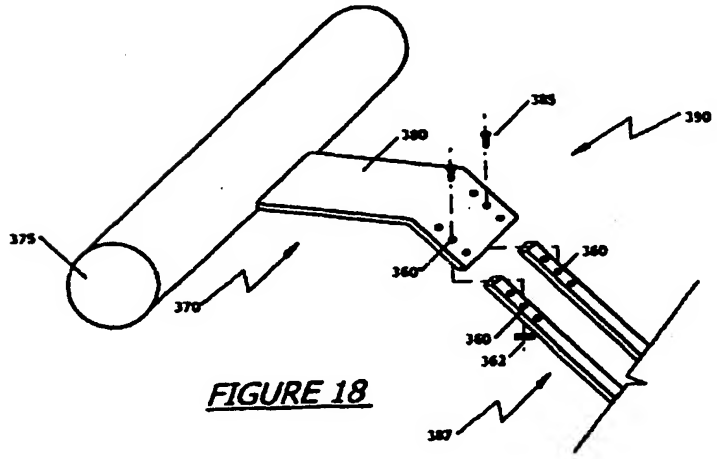

FIGURE 18